VITROPERM 550 HF

NANOCRYSTALLINE CORES FOR AUTOMOTIVE APPLICATIONS OFFERING VOLUME, WEIGHT & COST OPTIMIZED HIGH FREQUENCY-DESIGNS

Ideal for f >100 kHz
Adapted for SiC and GaN

Tape wound cores made of our new VITROPERM® 550 HF offer improved attenuation at high frequencies (HF, f > 100 kHz) in comparison to our standard VITROPERM 500 F cores and typical EMI ferrites. These cores enable high RFI-noise suppression in innovative filter designs with smaller volume and/or higher performance for future applications.

TARGET APPLICATIONS

Cores and common mode chokes for

- DC filter at drive inverter input
- AC filter at drive inverter output
- DC filter at HV (high voltage) battery
- DC/DC converter
- On-board charger

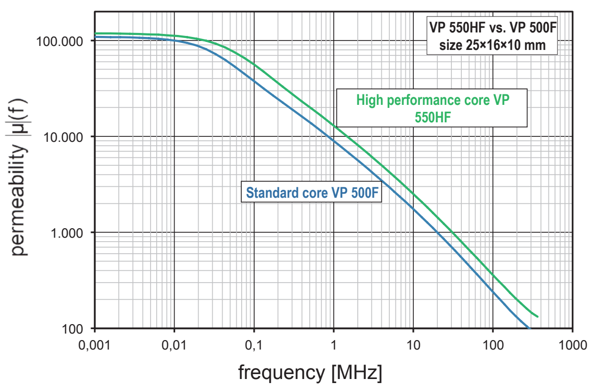
Common mode VITROPERM 550 HF cores offer the following features:

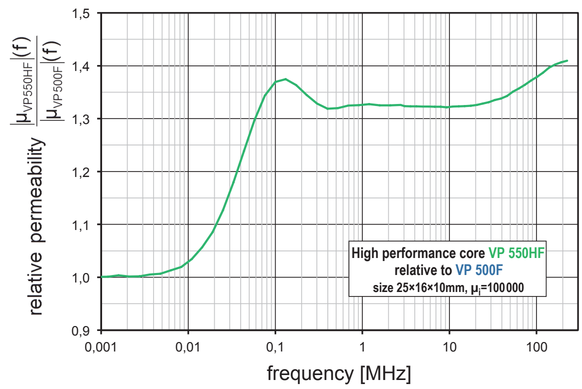
- Size/weight reduction compared to VITROPERM 500 F (VP) solutions
- Superior broadband insertion losses above 100 kHz as known from VP 500 F, relative permeability + 30%

MATERIAL DATA OF VITROPERM 550 HF (TYPICAL VALUES)

Saturation flux density	1.21 T (room temperature)
Coercivity (static)	< 2 A/m
Saturation magnetostriction	~ 1 x 10^{-7}
Specific electrical resistivity	115 µΩcm
Curie temperature	> 600 °C
Upper operational temperature	plastic casing: up to 150 °C*
	core mat.: 155 °C
	180 °C (lim. time)
Typical permeability lµl	~ 17,000 - 100,000 (10 kHz)

TYPICAL CHARACTERISTICS: VITROPERM 550 HF – VITROPERM 500 F

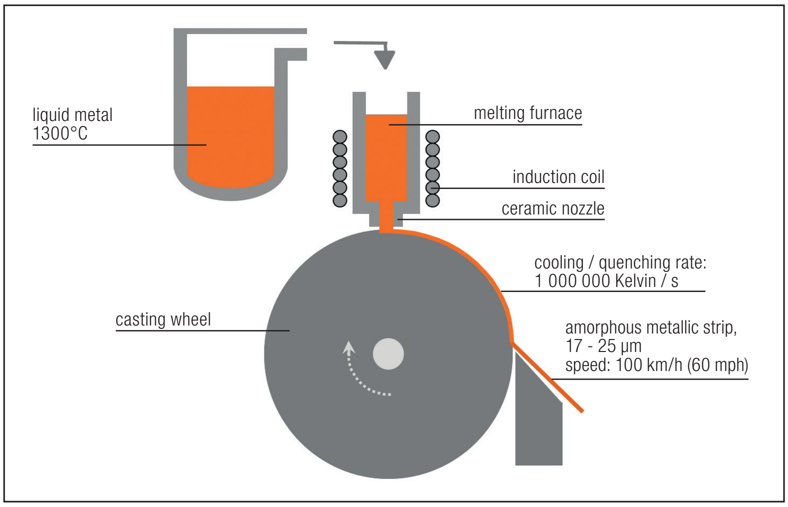




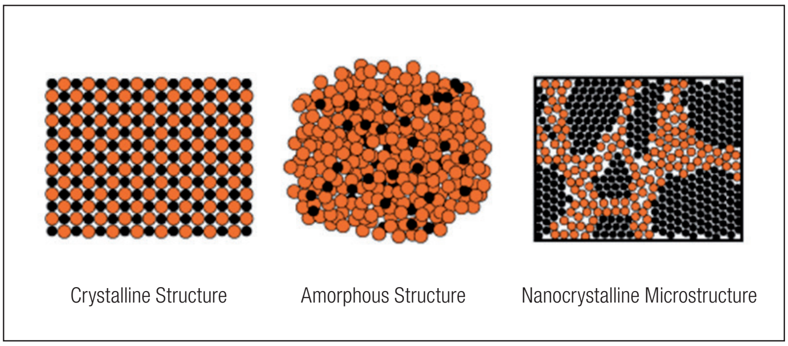
VITROPERM: Making the most of iron

The nanocrystalline VITROPERM® alloys are materials based on iron, silicon and boron with additions of niobium and copper. By using rapid solidification technology, which VAC is one of only very few companies in the world to have mastered, they are produced as strips in a single step in their final thickness. High-purity raw materials are melted at 1,300 °C and cast onto a cooled, spinning copper wheel. A cooling rate of 1 million degrees Kelvin per second results in an amorphous ribbon, which undergoes a heat treatment at 500 °C to 600 °C to form the nanocrystalline microstructure. On special winding machines, the strips are further processed into toroidal tape-wound cores with outside diameters of 2 mm to 600 mm.

The two-phase structure with fine crystalline grains (mean diameter 10 - 40 nm) resulting from the heat treatment is embedded in an amorphous residual phase. This structural feature is the prerequisite for achieving the highest permeability and the lowest coercivity values. In addition, the low ribbon thickness and the relatively high electrical resistance of 1.1 - 1.2 µΩm ensure the lowest eddy current losses and an excellent frequency response of the permeability. The combination of these properties together with a saturation flux density of 1.2 T and excellent thermal properties, make the nanocrystalline soft magnetic state-of-the-art VITROPERM material the universal solution for EMC problems, superior in many ways to conventional ferrites and amorphous material solutions.

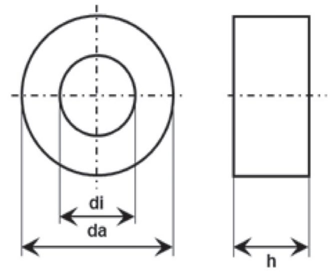


Rapid solidification technology for the manufacture of metal ribbons with an amorphous (vitreous) structure



Nanocrystalline cores and components have already been used with great success for many years in common mode suppression chokes (CMC) in automotive applications due to their superior soft magnetic properties. Through the use of cost-effective alloying elements (Fe based) and modern large-scale series production, VITROPERM has already established itself as a competitive solution in many diverse applications.

Toroidal cores



Typ T60006-L… T_{op} 150 °C	Dimension nominal d_a x d_i x h [mm]	A_{L0} nominal* [µH]		Saturation current I_{cm} [A], typical**			Iron cross section [cm²] A_{Fe}	Mean path length [cm] l_{Fe}	Weight core [g] m_{Fe}	Weight total [g] m
		10 kHz	100 kHz	DC	10 kHz	100 kHz				
2020-V412	23.2 x 9.8 x 11.05	59.0	20.2	0.2	0.2	0.5	0.24	5.1	9	11
2025-V414	28.1 x 13.05 x 13.05	71.2	24.4	0.3	0.3	0.6	0.36	6.4	17	20
2030-V416	33.1 x 17.0 x 18.1	94.4	31.7	0.3	0.4	0.7	0.57	7.8	33	38
2040-V418	43.0 x 21.95 x 18.1	103.1	36.2	0.5	0.5	0.9	0.86	10.2	64	70
2063-V420	66.75 x 46.1 x 28.35	58.8	28.5	1.2	1.2	2.1	1.23	17.7	156	174
2025-V422	28.5 x 16.7 x 14.8	35.7	12.0	0.3	0.3	0.6	0.20	7.1	10	14
2022-V424	24.9 x 11.6 x 16.0	86.6	29.1	0.2	0.3	0.5	0.39	5.8	16	20

Other designs available upon request.
*A_{L0}: inductance for N = 1 (tolerance +45 % / -25 % at 10 kHz, +∞ % / -25 % at 100 kHz)
**I_{cm}: the listed saturation currents are guidelines only. They are calculated for nominal core dimensions at room temperature and for approx. 70 % saturation flux density.

All data is subject to change without prior notice. The actual version of the respective data sheet is valid.

Example: T60006-L2025-V414

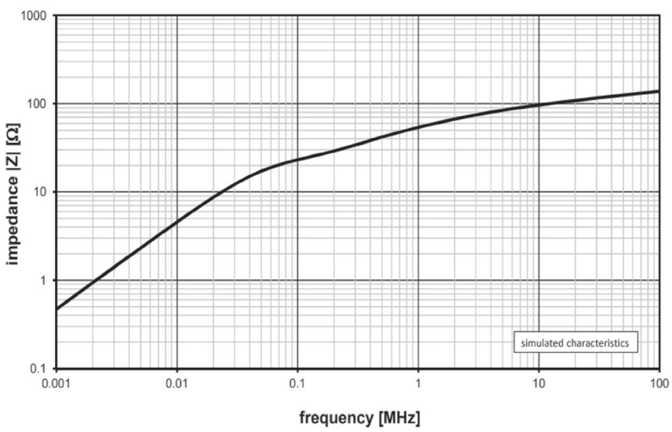


Fig. 1: Impedance |Z| [Ohm] / frequency [MHz]

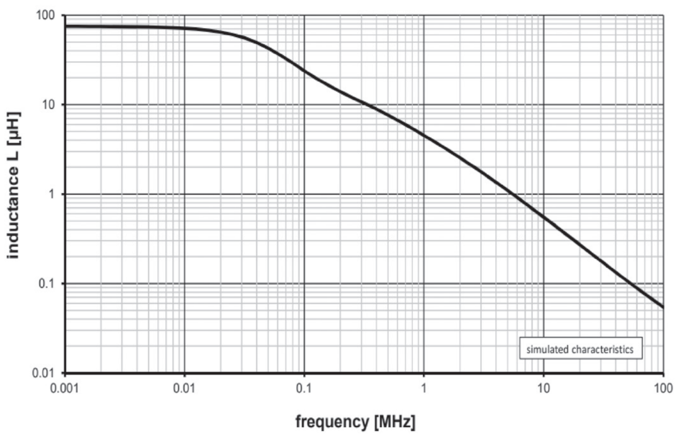
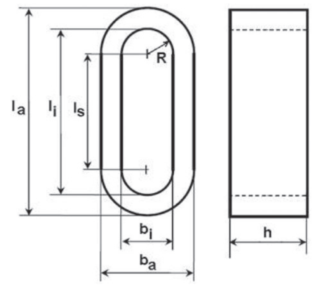


Fig. 2: Inductance A_L [µH] / frequency [MHz]

Oval Cores



Typ T60006-L… T_{op} 130 °C	Dimension l_a x b_a x h l_i x b_i [mm]	A_{L0} nominal* [µH]		Saturation current I_{cm} [A], typical*			Iron cross section [cm²] A_{Fe}	Mean path length [cm] l_{Fe}	Weight core [g] m_{Fe}	Weight total [g] m
		10 kHz	100 kHz	DC	10 kHz	100 kHz				
2058-V398	62.0 x 24.0 x 20.2 44.8 x 6.8	39.1	18.9	0.8	0.9	1.5	0.57	12.3	51	63
2071-V480	75.2 x 42.2 x 25.0 55.0 x 22.0	48.6	23.8	1.1	1.16	2	0.97	16.6	118	142
2104-V481	108.2 x 42.2 x 25.0 88.0 x 22.0	34.7	17.0	1.6	1.62	2.8	0.97	23.2	165	205

Other designs available upon request.
*A_{L0}: inductance for N = 1 (tolerance +45 % / -25 % at 10 kHz, +∞ % / -25% at 100 kHz)
**I_{cm}: the listed saturation currents are guidelines only. They are calculated for nominal core dimensions at room temperature and for approx. 70 % saturation flux density.

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Example: T60006-L2071-V480

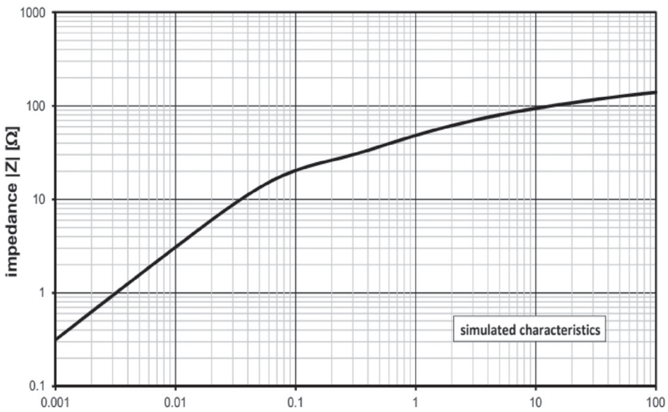

Fig. 3: Impedance |Z| [Ohm] / frequency [MHz]

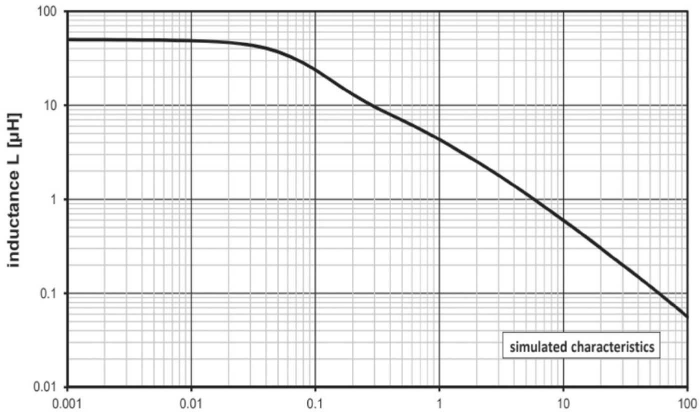

Fig. 4: Inductance A_L [µH] / frequency [MHz]

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ADVANCED MAGNETIC SOLUTIONS